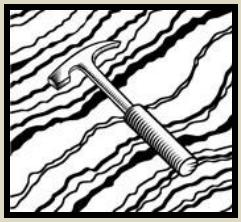
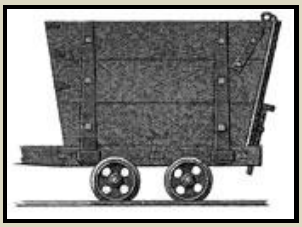
Gem Hunter – The Prospector's Newsletter





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PLACER GOLD

There are many geological designations & classifications for gold deposits. But for most prospectors, a simple classification scheme works well: (1) placer gold & (2) lode gold.

Placer deposits are those that can be worked with gold pans, long toms, dredges and similar concentrators designed to extract gold from unconsolidated sediment and use its very high specific gravity to recover the precious metal. Placers are often found in water or near water, but some can be high and dry.

Examples of placers include Nome and Flat, Alaska, the Yuba River, California, Alder Gulch, Montana; Douglas Creek, Big Atlantic Gulch and Rock Creek, Wyoming. There are also many dry placers that require one to haul water to the placer to beneficiate, such as the giant placers (estimated to contain 28.5 million ounces) at Dickie Springs-Oregon Buttes, Wyoming and the gold and possible diamond placer at Miracle Mile, Wyoming.

Gold placer at Flat Alaska.

In contrast to most placer deposits, lode gold is found in rock that is so hard it often requires blasting to break down the gold-bearing rock and then haul it to a mill or leach pad, to recover the gold. Famous lodes include the Mother Lode, California, Cripple Creek, Colorado and the Homestake, South Dakota. In Wyoming, lodes include Miners Delight, Carissa and Mary Ellen in the Wind River Mountains, and the Copper King near Cheyenne in the Laramie Mountains.

Faulted quartz vein (lode) exposed in bedrock (metatonalite) on the 120-foot level of the Mary Ellen gold mine, South Pass, Wyoming.

The GemHunter Newsletter
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Lodes are found in place in bedrock. They are defined as veins, seams, shear zones, faults, fold closures, breccias, disseminated and massive replacement deposits. Most of the time, it is possible to make a distinction between lode and placer deposits, but some are a little more difficult.

Take for instance, the great Witwatersrand deposits of South Africa. These are classified as paleoplacers (*'paleo'* meaning *'fossil'* or *'ancient'*) by geologists. Since the *'Rand'* paleoplacers are composed of very hard and brittle consolidated rock in well-defined seams in bedrock, these would be considered lodes by prospectors; but geologists see them differently. They are very old placers, or fossil placers, that were deposited in long-gone prehistoric river systems more than 2.5 billion years ago! After eons of time, the rocks were compressed, compacted, and recrystallized to produce a very hard rock currently mined to depths of 13,000 feet in Africa! These are rich gold deposits and nearly 40% of all gold mined in human history, was mined in the Rand.

Paleoplacers. *(Above left) Consolidated Tertiary rock deposited in a prehistoric stream possibly 20 million years ago. Note the rounded pebbles. (Above right) Very hard quartz pebble conglomerate deposited in an old river bed more than 2 billion years ago: note the rounded quartz pebbles in quartzite matrix. (Left) Stretched-pebble conglomerate deposited more than 2.5 billion years ago in a river. Note that the former rounded quartz pebbles are stretched along the horizontal axis and compressed along the vertical axis due to tectonic forces and compaction.*

All three of these rocks could potentially have anomalous gold along with other minerals of value such as diamonds. The very old placers (>2.5 billion years) often have uranium and thorium.

Placer gold is found as secondary detrital gold transported and reworked by water. This gold could be found in beaches, streams, rivers, alluvial fans, etc. Some placers form because of wave action along a beach at the edge of a lake, sea, or ocean, such as the great diamond deposits along the west coast of Namibia, Africa, or the famous gold deposits of Nome, Alaska.

Gold nuggets found at Julian Creek, Alaska. The large nugget (> 1 ounce) is stream worn and rounded suggestive of a distal source but the remaining nuggets provide conflicting evidence with features suggestive of a more proximal source for some of the gold.

Placers can be wet or dry. If formed in an active stream and eroded from a distal source, cobbles and boulders associated with the gold will be mostly rounded and stream worn, as would be much of the gold. If the placer is eluvial or proximal, it will contain angular cobbles and boulders and the deposit could sit high and dry away from running water with angular gold containing rough edges like corn flakes.

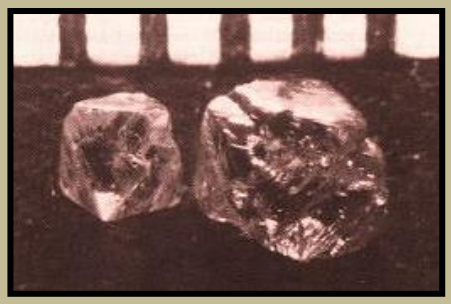
The gold content of placers will vary along the length of a stream and from surface to bedrock. In placer mining, it is important to learn about paystreaks. Paystreaks are zones enriched in gold due to past flash flooding events or because of some obstruction that dramatically reduced water velocity (such as a boulder) allowing the heavy gold to settle and be buried by silt, sand, pebbles and cobbles. Many placers will have more than one paystreak preserved in layers of coarse gravel.

When exploring placers, a prospector should also search for other valuable minerals, such as ruby, sapphire, diamonds, platinum, garnets, etc., and should always keep in mind that somewhere upstream the gold originated from a lode deposit. Was it a proximal source, a distal source, or was there more than one source upstream?

Smith Gulch placer, South Pass. Arrows above gold pan (circled) show the location of an upper pay streak. Lower arrow was the site of a lower paystreak, and beneath this, a third paystreak was found on bedrock. This

operation netted about 20 ounces of gold/week (~$30,000/week at today's gold price).

Because gold is very heavy (specific gravity 15 to 19) it will concentrate with other minerals of relatively high specific gravity referred to as black sands. Black sands are mostly composed of magnetite with other relatively heavy minerals such as ruby and sapphire, diamond, chromite, garnet, monazite, zircon, rutile, cassiterite, ilmenite, scheelite, platinum, palladium, sphene etc. Not all of these minerals are dark, but they still can be found in some black sands.



Gem-quality diamonds found by Paul Boden with placer gold in the Cortez Creek.

For example, in addition to gold, gem-quality diamonds were found at the Cortez Creek placer in the northwestern portion of the Medicine Bow Mountains of Wyoming by a prospector named Paul Boden from Saratoga. Thus somewhere upslope must be a source for these diamonds.

Near Poker Flat in California, I found gem-quality sapphire and benitoite in panned concentrates. Two prospectors from Rock Springs found a few hundred pieces of corundum (including one of 90 carats) in a placer near the southern tip of the Wind River Mountains. The corundum was poor quality, but the source remains undiscovered. Ruby schist with transparent ruby and pink sapphire was purportedly found a few miles upslope from this placer (Ron Frost, personal communication, 2005), but the source of the schist remains unverified as are similar reports of diamonds in Tourist Creek in the Wind River Mountains. While working at the Wyoming Geological Survey in Laramie, some students working on grants recovered specimens of ruby and sapphire in streams draining the east-central Laramie Mountains. The source of these rubies and sapphires has yet to be identified and were never followed up by our group because of a lack of sufficient funds.

If you would like to hunt for rubies and sapphires in this region, get a copy of Wyoming Geological Survey Open File Report 88-11 (includes several maps) and search the locations that list corundum in the heavy mineral suite in the Laramie Mountains. The corundum was only microscopic grains. But where found, these indicate that an aluminum-rich rock lies upslope (mica schist or vermiculite) with corundum, and the corundum could be of any size and quality.

While exploring for gold in Alaska, WestGold found placers at Donlin Creek in the Kuskokwim Mountains to be of great interest because the morphology of some gold nuggets and flakes indicated they were eroded from a proximal source over a large region. Some of the gold looked like corn flakes with jagged edges. Some nuggets looked so fragile they appeared as if they had directly precipitated from the water in the gulches. This led to a nearly $60 billion lode gold discovery.

At Julian Creek nearly 30 miles to the east, the creek yielded considerable gold, but much of the gold was rounded indicating an intermediate to distal source. However, the abundance of gold nuggets suggested that this area would be worthy of exploration for lode gold. For example, the day after we investigated this deposit, prospectors recovered an 11 ounce nugget along with several nuggets weighing up to an ounce or more. Some of these nuggets had interesting surface details suggesting that they were

not transported great distances. Somewhere along that drainage should be an excellent source for lode gold.

Panning along the banks of most active streams will produce black sands – the more black sands per gold pan, the better the placer trap. If you are an accomplished gold panner; you should be able to remove all of the light-colored material with low to moderate specific gravity from your pan in a very short time. This process can be sped up by using a combination grizzly pan with a gold pan, particularly where one encounters considerable coarse material mixed with fine material.

Minerals of relatively low to moderate specific gravity such as quartz, feldspar and mica need to be removed as they are worthless. Mica may be abundant and comes in varieties such as silver-white sericite, bronze phlogopite, black biotite, green chlorite, pink to lavender lepidolite and gold-bronze muscovite. Even though mica has low to moderate specific gravity (2.7 to 3.4) it forms two dimensional plates that are difficult to extract from a gold pan because they cut through the water like a knife. They also reflect light from a mirror-like surface and tend to roll around in the water during panning. If you need more information on these and other minerals – see Wyoming Minerals and Rocks.

A very fragile gold nugget projects from a rounded pebble. This nugget was found in the Donlin Creek area.

Through the years, hundreds of prospectors brought in samples to my lab at the Wyoming Geological Survey for identification. Many thought they had gold; but most (~99%) were fooled by mica. One novice spent an entire winter panning the Middle Fork of the Little Laramie River while recovering barrels of mica thinking it was gold (Hausel, 1999). He had gold fever that was unbreakable until I told him he only had barrels of potting soil.

A rule of thumb one can use to differentiate gold from mica: gold will not reflect light like a mirror, it will not roll or flip over and over in the water while panning; gold is too heavy and will stay on the bottom of the pan.

After a prospector sees native gold in a pan, mica is no longer mistaken for the precious metal. The color difference is distinct. Other minerals of interest that have relatively high specific gravity that may end up in your pan include cassiterite, garnet, scheelite, ruby, sapphire, sphene, chromite, zircon and diamond as well as metals with specific gravities close to gold such as mercury, platinum and palladium. Check these out with a microscope as you do not want to miss a potential source for tungsten, tin, or gemstones upstream.

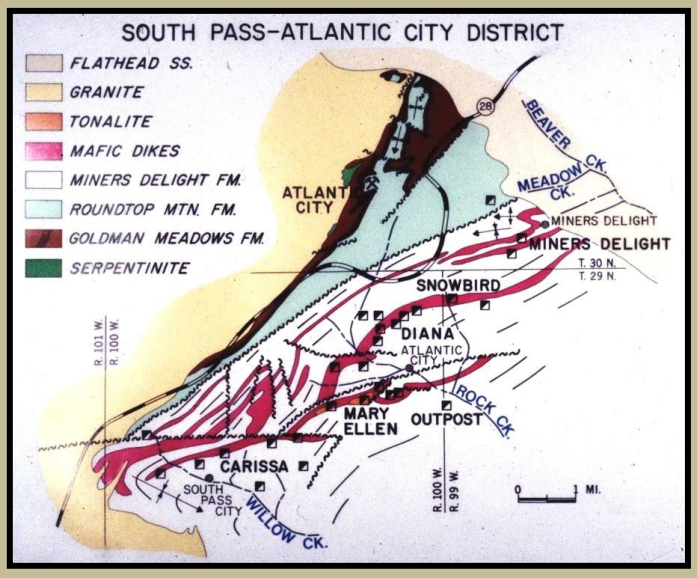
In streams, heavy minerals (dark and light colored) are intermixed with light colored minerals of low specific gravity. This mix tends to migrate downstream due to gravity and is accelerated with rainfall and flash-flooding. Nearly all placer gold paystreaks in deserts are related to flash flooding events. Many are found in fanglomerates with

angular cobbles and boulders. Thus better paystreaks (with few exceptions) are almost always associated with coarse gravel on bedrock, or can be several feet above bedrock.

Jay Roberts pans for heavy minerals in a creek in the Laramie Mountains. In this exercise, Jay used a grizzly pan (a pan with 0.25 inch holes drilled in the bottom), fly screen & gold pan. He initially sieved the material through the grizzly pan onto the screen & discarded the coarse material after looking for large nuggets & diamonds. Next he worked the material through the screen & panned all of the material which fell into the gold pan. Gold will stay in the bottom of the pan. Finally, Jay took the material that would not work through the fly screen & panned that separately looking for gemstones and gold. This dramatically increased panning time.

The carrying capacities of streams will diminish with decreasing water velocity. Thus greater amounts of heavy minerals tend to concentrate where a stream velocity shows a distinct decrease, such as along the leading edge of meanders, the bottom of the creek, behind obstructions (i.e., rocks, cracks in bedrock) and at waterfalls. Since many streams lack sufficient velocity to carry gold for any great distance, the vast majority of gold (particularly where concentrated in pay streaks) is likely transported during flash floods or heavy spring runoff. Evidence of flash floods may include coarse layers of mixed gravel (possibly with tree limbs and other organic debris) in layers separated by finer-grained gravel, sand and clay.

The distance heavy minerals are transported by water is not known with accuracy, but gold nuggets will concentrate near their source. A rule of thumb is the closer one gets to a gold source, the coarser the gold. This is seen in many districts including South Pass, Wyoming, where gold-bearing shear zones near South Pass City, Atlantic City and Miners Delight provide a good source for placer gold.



At Rock Creek coarse gold was found immediately downstream from the known lodes. The gold was recovered in Atlantic City and mined downstream for a distance of 7 to 8 miles before operations ceased in 1941. The fact that this dredge was still operating in 1941 at the outbreak of war at gold prices of only $35/ounce implies the operation likely

was still recovering economic amounts of gold. At the outbreak of the Second World War, all mining operations unnecessary to the security of the country were closed. Thus, Rock Creek likely still has commercial amounts of gold further downstream particularly at today's gold prices. This is also likely for Willow Creek which runs through South Pass City. However, Willow Creek was removed from exploration by the State of Wyoming as was the nearby Carissa Mine. The available geological data suggests that both are commercial gold deposits – thus one needs to question the intention of the State's withdrawal of these properties.

Some minerals can transport in streams for great distances, such as diamond. Diamond is 6000 to 8000 times harder than any other mineral except lonsdaleite (which is 30 to 58% harder than diamond but much rarer) and carbonado (both polymorphs of diamond). But diamond has moderate specific gravity of 3.52 compared to 2.87 for quartz. Because of its specific gravity, diamond is recoverable in a gold pan with black sands (*a rule of thumb is that if you are recovering garnets in your gold pan, you likely will retain diamonds if present, as they both have similar specific gravity)*. There are examples in Africa where diamonds appear to have transported more than 600 miles along the Orange River (Erlich and Hausel, 2000). Such great transportation distances for gold are not possible.

Where meanders occur in streams, if gold is present it will concentrate on the inside of the initial curve in the meander (where water velocity and carrying capacity of the stream declines significantly). Keep in mind that dry stream banks adjacent to a wet pay streak were deposited by the same stream in years past, thus if you find gold in the active stream, you will find gold in the bank adjacent to the stream, such as in the bank gravels along Douglas Creek in the Medicine Bow Mountains. And if you pan in this area, this is diamond country so keep an eye out for diamonds!

Diamonds from Wyoming (right). After teaching many diamond prospecting short courses over the years, it was apparent that few rock hounds, prospectors & geologists know how to identify diamond. Yet learning to recognize this valuable mineral that can sometimes be worth a hundred thousand times more than an equivalent weight of gold should be a priority. More photos of rough diamonds are available.

Paleoplacers for the most part are poorly explored due to lack of water. Thus, one has to find a source for water to mine these. Where paleoplacers are very old and well consolidated, such as the Witwatersrand in South Africa, gold is mined underground. Where paleoplacers consist of relatively unconsolidated gravel, they can be mined similar to sand and gravel operations. If the operation is near a road, the gravel can be sold and used in road bed construction. Conversely, gold can be extracted as a by-product from some sand and gravel operations (Hausel and others, 1993, 1994).

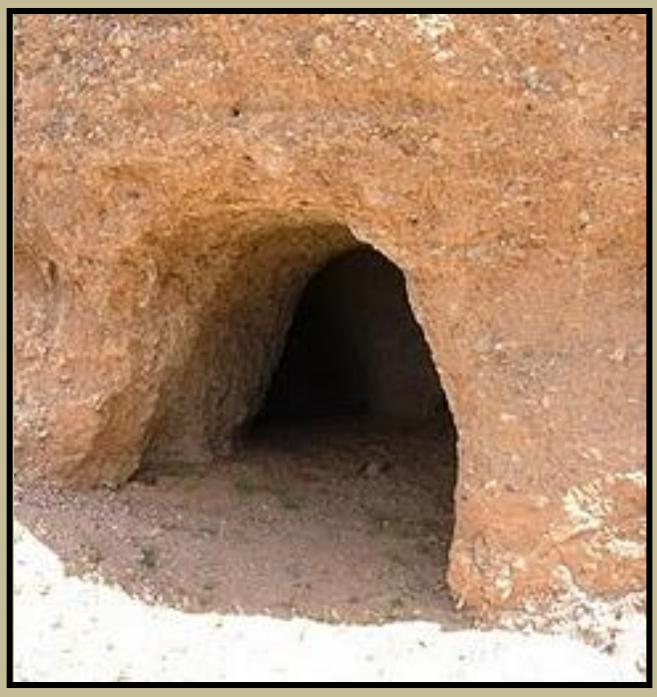
Paleoplacers and dry placers are common in Wyoming due to considerable erosion in the geological past. Some of these are gigantic and appear to have considerable gold and remain mostly unexplored. The Wyoming paleoplacers include ancient, consolidated, brittle, Proterozoic (~2 billion years old) paleoplacers in the Medicine Bow and Sierra Madre Mountains that are the unexplored equivalents of the Witwatersand deposits. These Wyoming deposits have produced several uranium, thorium, gold and diamond anomalies.

Other paleoplacers include poorly consolidated to unconsolidated Tertiary age paleoplacers and dry placers at South Pass, Seminoe Mountains and other localities in Wyoming as well as many dry placers in Arizona. Such large paleoplacers suggest that the gold and lithic fragments were derived from a nearby source terrain, and there are likely some very large undiscovered lodes in the South Pass area as well as rich hidden lodes near some gold-bearing fanglomerates in Arizona.

A gold-bearing fanglomerate near Dickie Springs, Wyoming has gold interspersed within sandy & silty matrix surrounding cobbles & pebbles. The rocks were derived locally (proximal source) suggesting that most, if not all of the gold, was derived from the South Pass greenstone belt that is now buried under Tertiary cover. Also note at the base of this prospect pit, cobbles are comparatively coarse & angular suggestive of flash flooding or heavy spring runoff. The Dickie Springs-Oregon Gulch paleoplacer was estimated to have 28.5 million ounces of gold according to the USGS! Where pebbles and cobbles are more rounded, higher gold contents are likely. Where they are more angular, gold content declines. Thus in this pit, higher gold contents were found in the upper part of the pit.

Gold found south of South Pass in the Dickie Springs-Oregon Gulch area occurs in a conglomerate with pebbles, cobbles and boulders that are for the most part relatively angular and suggestive of a nearby to eluvial source. In places, these paleoplacers have been modified and reworked by narrow and restricted intermittent streams which upgraded gold content – these have rounded pebbles. Thus higher gold contents are usually found in gravels with rounded pebbles and cobbles. Gold in much of this paleoplacer is often angular suggestive of a proximal or eluvial source.

Gold from eluvial deposits will show little or no evidence of transport. Some of these may be classified as fanglomerates –conglomerates that are part of an alluvial fan. Such conglomerates suggest little wear and tear from water transportation, although portions of fanglomerates and eluvial deposits. Gold in fanglomerates is usually angular.



Dry placer (fanglomerate) at the Vulture mine, Arizona. This is a consolidated conglomerate that geologists would classify as a dry placer due to abundant rounded stream worn pebbles. Even though it is Tertiary in age, it is consolidated enough to drive an adit into the conglomerate.

Eluvial deposits are essentially detrital material weathered in place from an underlying source rock. These are particularly abundant in arid regions of Arizona and New Mexico and most likely sit on or adjacent to lodes. Examples are the Greaterville placers in Arizona. These consist of mixed eluvial and alluvial material with angular rhyolite and granite lithic fragments. A few nuggets recovered from the deposit were described to have attached galena. The Greaterville placers are classified as placers, but because of close and intricate association with veins, many such deposits likely sit on top or just a short distance downstream from lodes.

Interested in finding gold? There are many placers and lodes in the West and many are currently claimed under the 1872 mining law (but many are overlooked) and a very large number have been withdrawn by the US Forest Service and US Bureau of Land Management.

Gold from the Dickie Springs-Oregon Gulch paleoplacers. Note that coarse flakes (0.25 inch across), have rough, angular edges, similar to corn flakes. This morphology indicates the gold was likely transported only a very short distance from its source rather than many miles as suggested by past researchers.

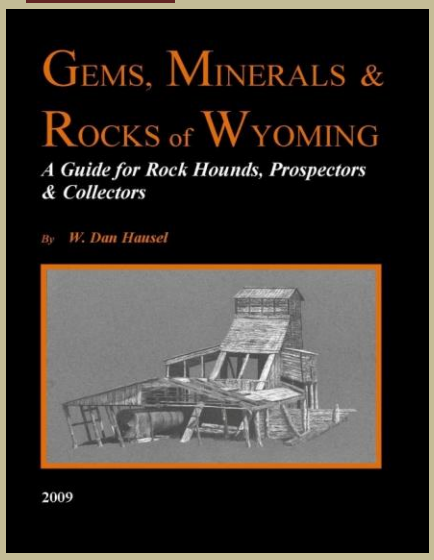
If you are new to prospecting, you will need to find out if the area you are interested in is still open to prospecting. One place to start is the BLM GeoCommunicator.

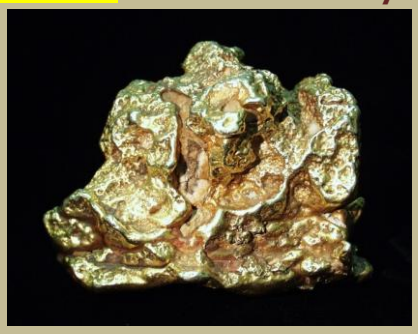
GOLD NUGGET FOUND IN CALIFORNIA

Following discovery of gold at Sutter's Mill in California in 1848, the ensuing rush resulted in considerable gold recovered by the 49ers. Gold has been recovered every year, but due to a bureaucracy run amok, only a small amount is now recovered. Even so, the state has considerable potential to produce gold and diamonds. The recent discovery of a large gold nugget provided more evidence of the treasure that awaits prospectors in that state.

BOOKS

Gems, Minerals and Rocks of Wyoming – A Guide for Rock Hounds, Prospectors and Collectors **is available from Amazon: or order it from your local bookseller.**





Watch for the first volume of *Gold in the West*. A book on how to find gold and other precious metals and where to find them. The book has been sent to reviewers and should be off to the printers after the review.

Over 3 decades, I found two (possibly 3) major gold deposits and hundreds of anomalies. I enjoyed finding them – now it's up to you to explore and mine them.

LINKS

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